

10. In particular, the specification discloses that it was known in the art that good crystal quality could be obtained by using a quartz crucible and graphite components of high purity. See specification at page 31, lines 10-18. However, it was not previously understood until discovered by the inventors that **other HZ components** made of quartz or even copper that do not directly contact the raw material melt and/or are not heated to a relatively high temperature, can serve as sources of Cu contamination. See specification at page 31, line 18 to page 35, line 7.

The specification is clear that the inventors focused on the purity of HZ components other than the quartz crucible: "...from traditional accomplishment of higher purity of the quartz crucible and the graphite components whose purity directly effects on the crystal quality, the other HZ components are focused attention on." See page 30, lines 14-18. The specification also states, beginning on page 32, line 25: "However, from the above-described result, it has been found that with respect to components made of quartz being used in such a low temperature position, things of high purity are required to be used as well as cases of high temperature." One of ordinary skill in the art would readily understand that "components made of quartz being used in such a low temperature position" would not include a quartz crucible.

For at least these reasons, Applicants respectfully submit that the recitation "the components made of quartz are other than the crucible" is fully supported by the specification. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

II. Rejections Under 35 U.S.C. §103

The Office Action, under 35 U.S.C. §103, rejects:

- (1) Claims 49 and 50 as having been obvious over U.S. Patent Application Publication No. 2003/0116082 to Sakurada et al. ("Sakurada") in view of U.S.

Patent No. 5,361,721 to Takano et al. ("Takano"), U.S. Patent No. 5,762,672 to Ikeda et al. ("Ikeda") and U.S. Patent No. 5,067,989 to Yokota et al. ("Yokota");

- (2) Claims 55-64, 74, and 78 as having been obvious over Sakurada in view of Takano, Ikeda and Yokota, and further in view of U.S. Patent Application Publication No. 2003/0000457 to Oda et al. ("Oda");
- (3) Claims 65-73 as having been obvious over Sakurada in view of Takano, Ikeda, Yokota and Oda, further in view of U.S. Patent No. 6,344,083 to Holder et al. ("Holder"); and
- (4) Claim 77 as having been obvious over Sakurada in view of Takano, Ikeda and Yokota, further in view of U.S. Patent No. 6,068,699 to Tsuji et al. ("Tsuji").

Applicants respectfully traverse the rejections.

A. Claim 49

The applied references do not provide any motivation to form a component made of quartz having the recited Cu concentration of "1 ppb or less" or "10 ppb or less." Takano discloses a quartz partition ring that directly contacts (i.e., is dipped into) a silicon melt and further teaches the use of a high-purity quartz glass to prevent contamination of the silicon melt. See col. 6, lines 50-60. Increasing the purity of components made of quartz that do not directly contact the silicon melt has not been conventionally performed due to problems associated with cost and production yield. However, as discussed in Applicants' specification, highly pure components made of quartz having the recited Cu concentrations are used even for components made of quartz, such as the observation window, that do not directly contact the silicon melt in order to prevent occurrence of the new type crystal defect in the Nv region.

For at least these reasons, while the partition ring and crucible disclosed in Takano and Ikeda that directly contact the silicon melt have high purity, the applied references do not provide any motivation for using components having high purity for components that do not directly contact the silicon melt. Thus, the applied references do not provide any motivation to make components (not directly contacting the silicon melt) having the recited Cu concentrations.

Therefore, the applied references would not have rendered obvious claim 49, and its dependent claims.

B. Claim 73

The Office Action asserts that Sakurada, Takano, Ikeda, Yokota and Oda discloses all the limitations of claim 73 except the recited leaving time and electric power. See page 7. The Office Action relies on Holder, which teaches melting an equilibrium phase of raw material for 3.5 hours, to cure deficiencies of the applied references with respect to the recited heating time. *Id.* The Office Action further asserts that an ordinarily skilled artisan would have modified Sakurada, Takano, Ikeda, Yokota and Oda "by using 80% or more of the power to melt the raw material more quickly, thereby increasing productivity." *Id.* Applicants respectfully disagree.

Holder does not disclose leaving a raw material for 3 hours or more after melting of the raw material. Instead, the "3.5 hours" melting time disclosed in Holder is the combined time of melting and the equilibration process. Thus, an ordinarily skilled artisan would not have applied the disclosed melting time of Holder to arrive at the recited limitation of leaving a raw material for 3 hours or more after melting of the raw material.

Furthermore, the Office Action's assertion that an ordinarily skilled artisan would have modified Sakurada, Takano, Ikeda, Yokota and Oda "by using 80% or more of the power to melt the raw material more quickly, thereby increasing productivity" is based on the

electric power during the melting of the raw material. However, claim 73 requires that the raw material "is left for 3 hours or more on a condition that a heating heater is heated with an electric power of 80% or more of the power in the raw material melting" after melting of the raw material. Once the raw material has been melted, an ordinarily skilled artisan would not have had any reason to use the recited electric power to further "melt the raw material more quickly."

Thus, the Office Action's assertion would not have motivated an ordinarily skilled artisan to achieve the recited electric power for leaving the raw material after melting of the raw material is finished.

For at least these reasons, Holder fails to cure the deficiencies of the other applied references. Therefore, the applied references would not have rendered obvious claim 73.

C. Claim 74

The Office Action asserts that Oda teaches cleaning the furnace body with the degree of cleanness set at class 1,000. See page 6. The Office Action further asserts that it would have been obvious to modify the teachings of Sakurada, Takano, Ikeda and Yokota "by transferring and cleaning in a high cleanness environment, as taught by Oda et al, to safely perform operations which would require cleanness without any problems of contamination." Applicants respectfully disagree.

Increasing the degree of cleanness is disadvantageous with respect to cost and production yield. Thus, an ordinarily skilled artisan contemplating increasing the degree of cleanness must have clear motivation to justify such disadvantages. The Office Action does not establish, and the applied references do not provide, any sufficient motivation to modify the teachings of Sakurada, Takano, Ikeda and Yokota to increase the degree of cleanness to the degree disclosed in Oda.

The fact that a cleaner environment is preferable, or to prevent problems of contamination, are not sufficient motivation to perform cleaning in a room having a degree of cleanness of class 1000 or more. Oda discloses that the degree of cleanness of class 1000 or more is the degree of cleanness for the room where the raw material is loaded. See paragraph [0040]. A degree of cleanness of class 1000 or more is a very high degree of cleanness, as compared to the degree of cleanness of class 10,000 at which the dismantled components of the inside of the furnace is cleaned. See Oda at paragraph [0040] (teaching that although the degree of cleanness of the uppermost floor is set at class 1,000, it is degraded to class 10,000 when cleaning is performed). To maintain a degree of cleanness of class 1000 or more during cleaning operations, an ordinarily skilled artisan must have sufficient motivation to justify the disadvantages discussed above, such as the motivation to set Cu concentration in the silicon single crystal to be less than 1×10^{12} atoms/cm³ and to prevent the crystal defects (which the present inventors found) from occurring in the Nv region. Oda does not provide any such motivation and does not teach that the recited degree of cleanness is necessary for cleaning operations.

Therefore, the applied references would not have rendered obvious claim 74.

D. Claim 77

Claim 77 requires forming a component made of quartz having the recited Cu concentration of "1 ppb or less" or "10 ppb or less," for example, the observation window. As discussed above with respect to claim 49, Applicants' specification discloses, highly pure components made of quartz having the recited Cu concentration being used even for components made of quartz that do not directly contact the silicon melt. Takano discloses a quartz partition ring that directly contacts (i.e., is dipped into) a silicon melt. See col. 6, lines 50-60. Thus, as discussed above, the applied references do not provide any motivation to

make components (not directly contacting the silicon melt) having the recited Cu concentration.

Therefore, the applied references would not have rendered obvious claim 74.

E. Claim 78

The Office Action does not address the claim limitation "wherein after melting of the raw material is finished, it is left for 3 hours or more on a condition that a heating heater is heated with an electric power of 80% or more of the power in the raw material melting." Such claim limitation is believed to distinguish over the art for at least the reasons discussed above with respect to claim 73.

Therefore, the applied references would not have rendered obvious claim 78.

F. Conclusion

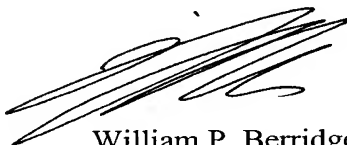
Accordingly, reconsideration and withdrawal of the rejections are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the claims are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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